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ABSTRACT

This study investigated the effects of instructionist (navigational, functional) versus constructionist (adaptive) World Wide Web (WWW) site environments on collaboration, achievement, attitudes, and perceived level of learner controls reported by students after working in cooperative dyads within the different types of Web-based learning environments. Three different versions of an instructional WWW site were developed, corresponding to the different types of interaction strategies. Twelve eighth-grade students (six dyads) were each assigned three similar instructional problems to solve, and they worked within the different Web environments to accomplish their instructional tasks. When the dyads experienced the navigational site, they viewed a main menu with broad topics displayed as hypertext links. When the dyads were assigned to the functional site, they began their exploration with a site-specific search engine. When the dyads experienced the adaptive (constructionist) site, they were instructed to construct a Web site that addressed the instructional problem. Preliminary results indicated a number of differences between the subjects' performance and behavior while experiencing the adaptive site versus the other two treatments. These included spending more time with the material, reporting a higher degree of learner control, a higher perception of interactivity, and an increase in the amount of positive interpersonal interactions. (Author/MES)

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INSTRUCTIONIST VERSUS CONSTRUCTIONIST WEB-BASED COLLABORATIVE LEARNING ENVIRONMENTS

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Abstract

This study investigated the effects of "instructionist" (navigational, functional) versus "constructionist" (adaptive) World Wide Web (WWW) site environments on collaboration, achievement, attitudes, perceived level of learner controls reported by students after working in cooperative dyads within the different types of web-based learning environments.

Three different versions of an instructional WWW site were developed, corresponding to the different types of interaction strategies. Twelve 8th-grade students (6 dyads) were each assigned three similar instructional problems to solve, and they worked within the different web environments to accomplish their instructional tasks. When the dyads experienced the navigational site, they viewed a main menu with broad topics displayed as hypertext links. Selecting a particular link displayed a listing of specific informational pages related to the topic. This type of environment was classified as "instructionist" due to its relatively low degree of learner interactivity and the inherently linear format of the information presentation. When the dyads were assigned to the functional site, they began their exploration with a site-specific search engine. After entering one or more terms, the search engine displayed topic pages and/or specific information pages related to the terms submitted. When the dyads experienced the adaptive (constructionist) site, they were instructed to construct a web site that addressed the instructional problem.

Preliminary results indicated a number of differences between the subjects' performance and behavior while experiencing the adaptive site (construction) versus the other two treatments. These included spending more time with the material, reporting a higher level of interest in the instructional material, trying harder to learn the material, reporting a higher degree of learner control, a higher perception of interactivity, and an increase in the amount of positive interpersonal interaction.

Recommendations for future research are also included.

Introduction

"Interactivity" as it relates to computer-based instruction (CBI) is commonly defined as the degree to which user input affects message presentation. With the emergence of the WWW as a viable and somewhat homogeneous computer-mediated environment, distinct types of web-page interactivity have emerged. Web pages may include interactive strategies classified as navigational, functional, or adaptive (Guay, 1995). The characteristics of these different website design strategies follow:

Type of Web Interactivity	Description	Relative Degree of Interactivity
Navigational (instructionist)	• Focus on navigating information space • Hypertext menus and/or individual links • Control limited to what user can access "next"	Low
Functional	• User interacts with system to accomplish goal by making decisions about what information is available on a page • User receives feedback throughout interaction • Common examples include search engines, games, accessing databases	Medium
Adaptive (constructionist)	• Similar to functional site, except user adapts information space to meet specific needs or desires • User "authors" information site	High

The "navigational" web environment is loosely classified as *instructionist* due to its relatively low degree of learner interactivity and the more structured nature of the information organization and presentation. Papert (1993) describes instructionist learning environments as those learning situations subscribing to a teacher-centered paradigm in which students assume the role of information recipient. He contrasts "instructionism" with what he refers to as "constructionism," which represents learner-centered educational experiences focusing on student creations or constructions. As students construct things in the real world (or the classroom), these experiences support the construction of knowledge structures in the head. Constructionism, in a sense, represents operationalized constructivism.

Adaptive web environment can be classified as "constructionist" due to their relatively high degree of learner interactivity and the fact that learners have an opportunity to create their own web environments. Adaptive web experiences range from using web editors to create web pages and sites, to more structured creation strategies in

which users make specific design decisions about existing web pages (for example, see the adaptive features used within the websites described by de La Passardiere & Dufresne, 1992; and Eklund, 1996). As it becomes easier to create web pages and sites, opportunities for the use of adaptive web experiences within instructional settings are increasing.

This exploratory study was designed to examine the effects of navigational, functional, and adaptive web-based learning experiences on a number of dependent variables, including achievement, attitudes, and perceived level of learner control.

Method

Part of the exploratory nature of this study involved the development of different versions of the instructional websites corresponding to the different types of interaction strategies. The first step in the instructional web development process involved the creation of a website that contained individual pages with content that could be categorized in a number of ways. "Battles of the Civil War" was chosen as the topic for this study because the subject matter lent itself to the subject pool (junior high school and high school students), and because the topic was broad enough to support the different types of web environments under development. The following chart summarizes the main characteristics of each web type developed:

Web Type	Characteristics
Navigational	This type of web environment consisted of an introduction page that displayed the information about one of the selected battles (for example, the battle of Shiloh was the first battle studied by all the groups). A link on this page led to a main menu page with broad topics displayed as hypertext links. Selecting a particular link displayed a listing of specific informational pages related to the topic. See Figure One for a sample.
Functional	This type of web environment consisted of an introduction page that displayed the information about one of the selected battles. A link on this page led to a search page that required the inputting of terms to display links to specific informational pages related to the terms selected. Subjects could also choose how the links to the requested term(s) would be displayed: alphabetically, by timeline, by location, by people involved, and by battle event. See Figure Two for a sample.
Adaptive	In this environment, the students were directed to the same introduction and search pages as displayed in the Functional group. They were then directed to construct their own website that could help other students (and themselves) learn the information needed to successfully answer questions about the battle. All students had experience using Netscape Composer to create local webpages. The students were informed that they could use any resources on the web, but that the pages found within the local Civil War site did include an adequate amount of basic information.

The subjects for this study were twelve 8th-grade students who were participating in an afterschool enrichment program at a middle school in a small rural Midwestern town. These students volunteered to participate in the enrichment program, which usually involved a good deal of extra time spent on the school's computers using the Internet for independent research. Most of the time, these students worked in pairs or triads to complete assigned group project work. Seven females and nine males participated in this study.

During the first afterschool meeting constituting the study, the subjects were informed that they were going to study a web-based unit of instruction about some of the important Civil War battles. They were told that successfully completing these units of study would help them perform better on the standardized history questions to be presented on their standardized tests administered at the end of the year. They were also informed that their performance on the unit quizzes would be ranked, and the highest-ranking student at the end of the unit would receive a special Civil War prize. The subjects were also informed that they were going to be randomly assigned to cooperative dyads for the unit.

The subjects were informed that the Civil War unit would cover three important battles: the battle of Shiloh, the battle of 2nd Manassas (the second battle of Bull Run), and the battle of Gettysburg. The subjects were also informed that the information to be studied was web-based, and that they would study each battle in a different way during the unit. During the first week, all groups studied the battle of Shiloh. Two groups were randomly assigned to one of the three different types of web environments (navigational, functional, or adaptive).

No time limits were imposed on any of the groups. The students met regularly for one and a half hours, three times per week. The students were told that they could take the quiz whenever they felt ready. When a group indicated that they were finished studying their assigned battle, they were administered a brief attitude questionnaire followed by a 20-question multiple-choice quiz. After taking the survey and quiz, they were assigned to one of the other battles under a different web-based condition, according to the schedule below:

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	Navigation	Functional	Adaptive
Shiloh	1, 4	3, 5	2, 6
Manassas	2, 5	1, 6	3, 4
Gettysburg	3, 6	2, 4	1, 5

The students worked in a small computer lab in a corner of the school's media center. Although the lab contained 15 computers, only six were turned on, with the two members of each dyad sharing a single computer. After all the students had studied all the battles, the quiz scores, time, and attitude survey data were tabulated.

Results

The mean quiz scores for each battle by instructional web type are presented in Table One. These data indicate that the mean score for all 12 subjects on the battle of Shiloh quiz was 14.1, the mean score for the Manassas quiz was 15.5, and the mean score for the Gettysburg quiz was 16.6 out of a possible 20 correct. Table One also presents the quiz scores by instructional web type. These data indicate that the mean quiz score for the 12 students experiencing the navigational web type was 14.4, the mean score for all subjects experiencing the functional web type was 14.9, and the mean quiz score for students experiencing the adaptive web type was 16.9.

Table Two presents the average amount of time spent experiencing the different battle webs. These data indicate that the mean time for all 12 subjects studying the battle of Shiloh web was 89 minutes, the mean time studying the Manassas web was 116 minutes, and the mean time experiencing the Gettysburg web was 112 minutes. Table Two also presents time by instructional web type. These data indicate that the mean time spent by the 12 students experiencing the navigational web type was 61 minutes, the mean time spent by all subjects experiencing the functional web type was 67 minutes, and the mean time spent by students experiencing the adaptive web type was 190 minutes.

Table Three presents the mean attitude item responses by type of web. Many of the responses to these items were very similar across web types, but some of the items appeared to have a wide variation in responses. After experiencing the navigational web, subjects appeared to strongly agree with the statement "The structure of this website encouraged me to explore all the information presented about my assigned Civil War battle" (3.6). In contrast, after experiencing the functional website the subjects reported a 2.4 on this item, indicating that they did not agree with the statement as strongly. Subjects experiencing the functional website also reported relatively lower agreement with the statements "I had control over what I learned related to the Civil War while using this Civil War websites" (2.8) and "I am confident that I will do well on a quiz over this battle" (2.8). The data in Table Three also indicate that the subjects reportedly agreed more strongly with a number of statements after experiencing the adaptive website relative to the other two types of web-based experiences. These statements included

"Learning about this Civil War battle was interesting" (3.7), "I had control over what I learned related to the Civil War while using this Civil War websites" (3.8), "I had control over the Civil War information presented on the computer" (3.8), "I am confident that I will do well on a quiz over this battle" (3.7), and "I tried hard to learn the information presented about this battle" (3.8).

When asked to rate the level of interactivity each type of web experienced offered, subjects reported less interactivity in the navigational experience (1.6), relatively moderate amount of interactivity in the functional web experience (2.2), and relatively higher interactivity in the adaptive web experience (2.8). These data are also reported in Table Three.

Discussion

Due to the limited number of subjects participating in this pilot study, not many conclusions can be drawn about differences in performance and attitudes between subjects assigned to the different treatment groups. However, based on the preliminary data collected, a number of observations and questions seem worthy of further discussion and subsequent investigation. For example, subjects appeared to score higher on those quizzes that addressed information over the battles for which they developed websites (adaptive). The following observations and attitudinal responses may help explain why:

Time	Subjects spent much more time with the material as they developed their websites.
Motivation	Subjects reported that they were more interested in learning about their "adaptive" battle.
Effort	Subjects reported that they tried harder to learn about their "adaptive" battle.
Control	Subjects reported that they felt as if they had more control over the information presented as well as more control over their own learning while creating their battle website.
Interactivity	Subjects reported that they felt the adaptive experience was more interactive than the other experiences. Also, the additional time spent working together on creating the website increased the amount of time the dyad members spent interacting with each other.

All of the factors described above may have influenced the amount of information "learned" from the Civil War battle site. Certainly, a positive relationship should exist between the amount of time spent with a topic and the recall of information associated with it. In the same vein, the adaptive website did require a lot more effort on the part of the learners to understand and organize the material well enough to generate an informational web page about the assigned topic. And given the probable personality type of students who would choose to participate in a voluntary afterschool enrichment program, an increase in interest for a topic requiring a lot more "work" isn't surprising. It is also possible that the construction assignment within the adaptive experience provided a meaningful context for learning about the relatively abstract content associated with a war fought over 200 years ago. It would be interesting to see if similar results are obtained from students across a wider range of academic ability and experience.

Perhaps the most intriguing aspect of these VERY LIMITED and PRELIMINARY findings is the notion that differences in perceived learner control as well as interactivity may have influenced learning. Although degree of interactivity has not been a research variable in many studies involving CBI, a related concept that has been investigated by researchers is "learner control." Learner control within computer-mediated environments has been an important instructional design variable during the past 15 years of instructional technology research. Learner control has been defined and operationalized differently throughout a number of studies (see Reeves, 1993; Ross, et al, 1989), and findings from various learner control studies are mixed (see Friend & Cole, 1990; Large, 1996). Although learner control strategies have varied within different research studies, one factor that has helped to delimit all types of learner control is "interactivity." In the case of a number of learner control studies, the users could choose to access specific types of information related to elements of an instructional program. These elements included additional examples, ancillary information, additional practice items and specific types of feedback (see Hannafin & Sullivan, 1995; Lee & Lee, 1991; Pridemore & Klein, 1993). A closer examination of different learner control studies reveals that none explicitly manipulated variables directly related to degrees of interactivity, and very few studies included data indicating the perceived level of control learners reported after interacting with the computer-mediated learning environment (Schwier, 1993). The relationship (if any) between perceived learner control, degree of interactivity, and learning would be an excellent focus for subsequent investigation!

Another important factor related to interactivity that presumably has an impact on learning within cooperative dyads is the type of social interactions occurring between group members. Originally, each dyad in this study was going to be videotaped, and the nature of group member interaction was going to be examined. The school district where this study took place had a policy against videotaping students; consequently, social interactions were not studied. In future studies, group member interaction will be closely observed, and the following types of interactions will be documented:

- Shared the mouse and/or keyboard
- Helped explain information
- Helped summarize the information presented
- Helped discern relevant information
- Asked for help
- Collaborated on making navigation decisions
- Did not respond to solicitation for help
- Checked for partner's understanding
- Encouraged partner
- Off-task

Perhaps the most important elements provided by "constructionist" learning environments like the adaptive type employed in this study are more dynamic and constructive social interactions within a meaning and purposeful learning context. Productive social interactions between group members (as well as human-computer interaction) may be a key element for deeper cognitive processing, more motivation to learn, and more effort employed by the learners. If this is true, then the additional time needed may be justified.

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Figure One. "Navigational" Website Sample

The American Civil War

Directions: Next week, you will be given a quiz over the **Battle of Shiloh**, one of the important Civil War battles fought in Tennessee. This quiz will include multiple-choice questions about the following aspects of the battle:

1. Dates
   - Timeline of events leading up to battle
   - Timeline of battle events
   - Timeline of events following the battle
2. Battle
   - Location(s)
   - Detailed Battle Timeline
   - Events
   - Outcome
3. Impact of battle
4. People
   - Military leaders
   - Other important figures
5. History
   - Official reports
   - Historical reflections
   - Historical commentary

Click the arrow below to access a main menu of links to access specific information about the Battle of Shiloh.

To the Main Menu

Battle of Shiloh Main Menu

Dates

- Timeline of events leading up to battle
- Timeline of battle events
- Timeline of events following the battle

Battle Info

- Location(s)
- Detailed Battle Timeline
- Events
- Outcome

Impact of battle

People

- Military leaders
- Other important figures

History

- Official reports
- Historical reflections
- Historical commentary

Back to Battle of Shiloh Introduction Page

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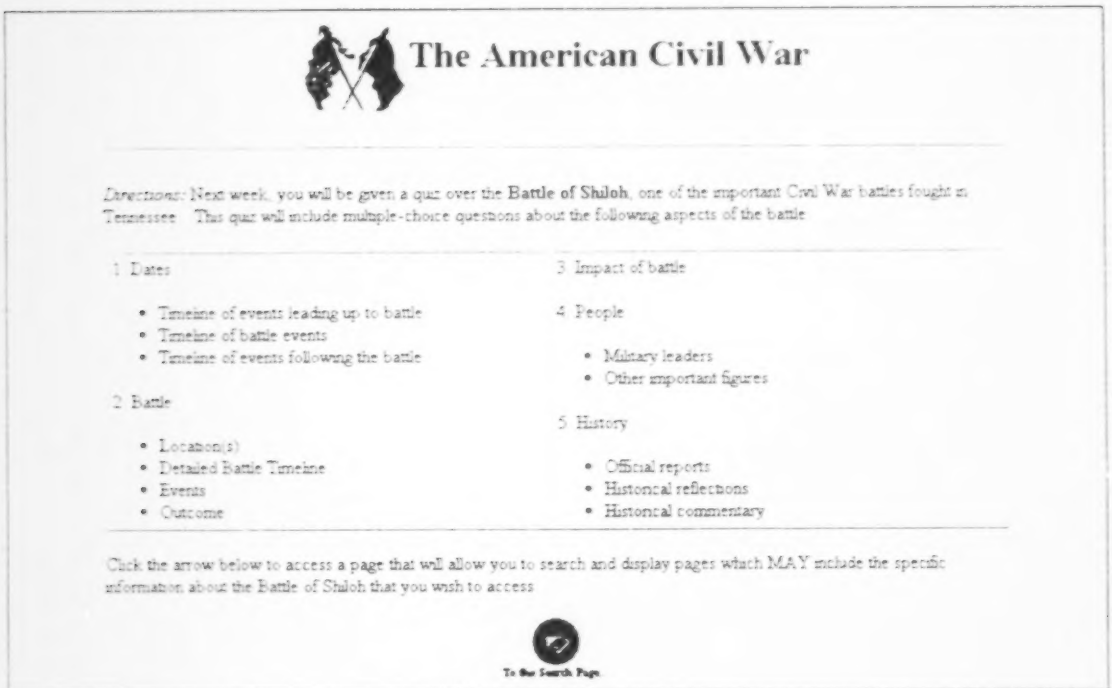
Figure 2. "Functional" Website Sample



The American Civil War

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   - Timeline of events leading up to battle
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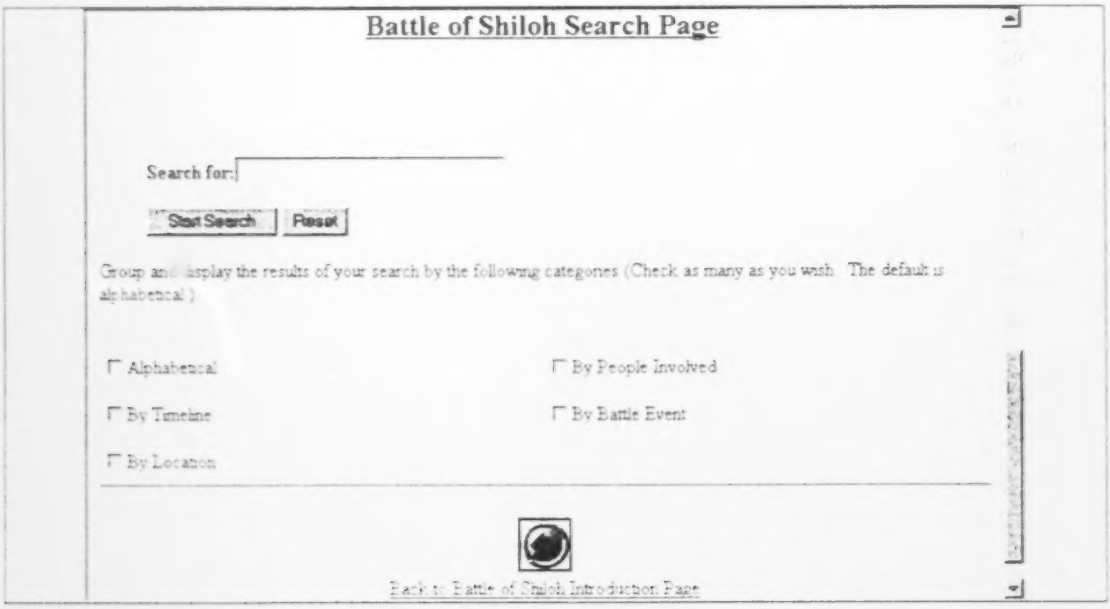
   - Timeline of events following the battle
2. Battle
   - Location(s)
   - Detailed Battle Timeline
   - Events
   - Outcome
3. Impact of battle
4. People
   - Military leaders
   - Other important figures
5. History
   - Official reports
   - Historical reflections
   - Historical commentary

Click the arrow below to access a page that will allow you to search and display pages which MAY include the specific information about the Battle of Shiloh that you wish to access.

To the Search Page



Battle of Shiloh Search Page

Search for:

Start Search | Reset

Group and display the results of your search by the following categories (Check as many as you wish. The default is alphabetical.)

- ☐ Alphabetical
- ☐ By Timeline
- ☐ By Location
- ☐ By People Involved
- ☐ By Battle Event

Back to Battle of Shiloh Introduction Page

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Table 1. Quiz Score Means by Battle and Instructional Web Type

Battle	Instructional Web Type			Total
	Navigational	Functional	Adaptive	
Shiloh	13.2[a]	12.4	16.7	14.1
Manassas	14.3	15.7	16.5	15.5
Gettysburg	15.8	16.5	17.4	16.6
Total	14.4	14.9	16.9	15.4

Notes: 20 possible correct answers per battle. [a]Each battle by web type cell reflects mean quiz scores for 4 students in 2 dyads.

Table 2. Mean Time (Minutes) by Battle and Instructional Web Type

Battle	Instructional Web Type			Total
	Navigational	Functional	Adaptive	
Shiloh	52[a]	43	173	89
Manassas	67	82	201	116
Gettysburg	64	77	195	112
Total	61	67	190	106

Notes: [a]ach battle by web type cell reflects the time for 2 dyads each.

Table 3. Attitude Response Means by Web Type

Survey Item	Web Type		
	Navigational	Functional	Adaptive
Learning about this Civil War battle was interesting.	3.2[a]	2.9	3.7
I would like to visit other Civil War websites on the Internet.	3.3	3.4	3.6
I would like to learn more about the Civil War.	3.4	3.3	3.5
I tried hard to learn the information presented about this battle.	3.2	3.5	3.8
I had control over what I learned related to the Civil War while using this Civil War websites.	3.1	2.8	3.8
The structure of this website encouraged me to explore all the information presented about my assigned Civil War battle.	3.6	2.4	3.6
I had control over the Civil War information presented on the computer.	3.0	3.5	3.8
I am confident that I will do well on a quiz over this battle.	3.1	2.8	3.7
Rate the level of interactivity you experienced while learning about this battle from the computer.[b]	1.6	2.2	2.8

Notes: Each cell represents 12 students (from 6 dyads) responding. [a]The scale for these items was: 4 = strongly agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree. [b]The rating scale for this item was: 0 = Not interactive at all, 1 = A little interactive, 2 = Fairly interactive, 3 = Very interactive.

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